



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/580,606

05/25/2006

Yoshimichi Harada

01600091AA

4979

30743

7590

12/24/2008

WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C.

11491 SUNSET HILLS ROAD

SUITE 340

RESTON, VA 20190

EXAMINER

CRAWFORD, LATANYA N

ART UNIT

PAPER NUMBER

2813

MAIL DATE

DELIVERY MODE

12/24/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/580,606	Applicant(s) HARADA ET AL.	
	Examiner LATANYA CRAWFORD	Art Unit 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 October 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 25 May 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>05/25/2006</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This Office Action is in response to the restriction election filed 09/11/2008. The restriction requirement made 10/10/2008 has been reviewed and is withdrawn (MPEP § 811 and 811.03). Currently, **Claims 1 - 22** are pending.

Information Disclosure Statement

2. The information disclosure statement filed 05/25/2006 fails to comply with 37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information, of each patent listed that is not in the English language. It has been placed in the application file, but the information referred to therein – foreign patent documents JP 2004-47873, JP2002-252222, JP2002-118169, JP2001-326222, and JP 2001-230244 – have not been considered.

Claim Objections

3. Claim 18 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 18 discloses formula 1. Formula 1 is disclosed in claim 3 which depends from independent claim 2. Currently, claim 18 depends from claim 16, claim 11, and claim 1, where formulas 2-4 are disclosed. To further prosecution the Examiner interprets that claim 18 depends from claim 8.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

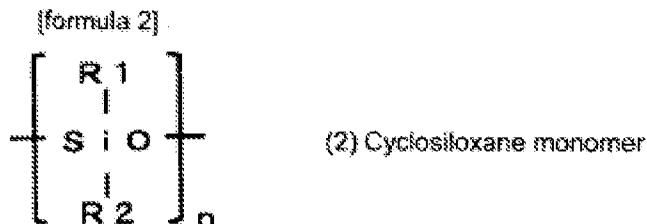
A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 5-7, 9, 11-13, 16, &19-21 are rejected under 35 U.S.C. 102(e) as being anticipated by Miyoshi (US Pub no. 2004/0253777 A1).

Regarding claim 1, Miyoshi et al. discloses a method of producing a porous insulating film, comprising the step of: introducing gas containing vapor of cyclic organic silica compounds [0043-0047], which have silicon and oxygen skeletons and have at least one unsaturated hydrocarbon group bound with a side chain of a skeleton [0046], into plasma to grow a porous insulating film on a semiconductor substrate (19) [0061] [0049-0050] [0064-0070].

Regarding claim 5, Miyoshi et al. discloses wherein said cyclic organic silica compounds are cyclosiloxane monomers represented by the following formula (2):

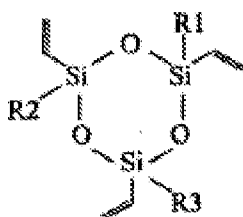


Art Unit: 2813

where R1 and R2 are respectively any one of the group consisting of hydrogen, an alkyl group, an alkoxide group, an amino group, alkene, alkyne, a phenyl group and a phenol group, provided that R1 and R2 may be the same or different, provided that at least one of the side chain groups is an unsaturated hydrocarbon group, and n is an integer of 2 or more [0043-0044].

Regarding claim 6, Miyoshi et al. discloses said cyclic organic silica compounds are trivinylcyclotrisiloxane derivative monomers represented by the following formula (3) [0044]:

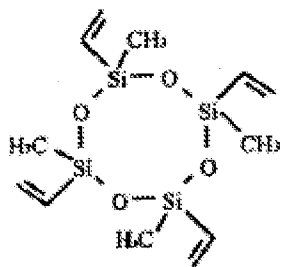
[formula 3]



(3) Trivinylcyclotrisiloxane derivative

Regarding claim 7, Miyoshi et al. discloses wherein said cyclic organic silica compound is tetravinyltetramethylcyclotetrasiloxane monomers represented by the following formula (4):

[formula 4]



(4) Tetravinyltetramethylcyclotetrasiloxane

where R1 and R2 are respectively any one of the group consisting of hydrogen, an alkyl group, an alkoxide group, an amino group, alkene, alkyne, a phenyl group and a phenol group, provided that R1 and R2 may be the same or different, provided that at least one of the side chain groups is an unsaturated hydrocarbon group, and n is an integer of 2 or more [0044].

Regarding claim 9, Miyoshi et al. discloses said plasma is plasma of rare gas [0055].

Regarding claim 11, Miyoshi et al. discloses a porous insulating film produced by the method of producing a porous insulating film according to claim 1 [0061] [0049-0050] [0064-0070].

Regarding claim 12, Miyoshi et al discloses the porous insulating film comprising at least silicon, carbon, oxygen and hydrogen and having a Raman spectrum corresponding to at least three-membered silica skeleton in the Raman spectroscopic analysis [0044] (inherent to the chemical structure of SiOCH).

Regarding claim 13, Miyoshi et al. discloses wherein ratios of elements in the film is: O/Si = 0.8 to 1.2, C/Si = 1.5 to 10.0 and H/Si = 4.0 to 15.0 (tetravinyltetramethylcyclo-tetrasiloxane C₁₂H₂₄O₄Si₄) [0044].

Regarding claim 15, Miyoshi et al. teaches at least a part of pores contained in the film have almost the same diameters as a skeleton of said cyclic organic silica compounds (inherent to the compound and porous insulating film tetravinyltetramethylcyclo-tetrasiloxane C₁₂H₂₄O₄Si₄) [0044] .

Regarding claim 16, Miyoshi et al. discloses a semiconductor device using the porous insulating film according to claim 11 as a layer insulating film of a multilayer wiring [0002-0003].

Regarding claim 19, Miyoshi et al. discloses said cyclic organic silica compounds are cyclosiloxane monomers represented by said formula (2), where R₁ and R₂ are any one selected from the group consisting of hydrogen, an alkyl group, an alkoxide group, an amino group, alkene, alkyne, a phenyl group and a phenol group, provided that R₁ and R₂ may be the same or different, provided that at least one of side chain groups is an unsaturated hydrocarbon group, and n is an integer of 2 or more [0044].

Regarding claim 20, Miyoshi et al. discloses said cyclic organic silica compounds are tetravinyltetramethylcyclo-tetrasiloxane monomers represented by said formula (4) [0044].

Regarding claim 21, Miyoshi et al. discloses said cyclic organic silica compounds are trivinylcyclotrisiloxane derivative monomers represented by said formula (3) [0044].

6. Claims 2, 3, 8, 18 & 22 are rejected under 35 U.S.C. 102(e) as being anticipated by Miyoshi (US Pub no. 2004/0253777 A1).

Regarding claim 2, Miyoshi et al. discloses a method of producing a porous insulating film, comprising the step of: introducing vapor of cyclic organic silica compounds, which have silicon and oxygen skeletons and have at least one unsaturated hydrocarbon group bound with a side chain of a skeleton [0043-0047], and vapor of straight-chain organic silica compounds, which have silicon and oxygen skeletons and have any one selected from the group consisting of hydrogen, a hydrocarbon group and a hydrocarbon oxide group bound with a side chain of a skeleton[0043-0047], into plasma to grow a porous insulating film on a semiconductor substrate[0061] [0049-0050] [0064-0070].

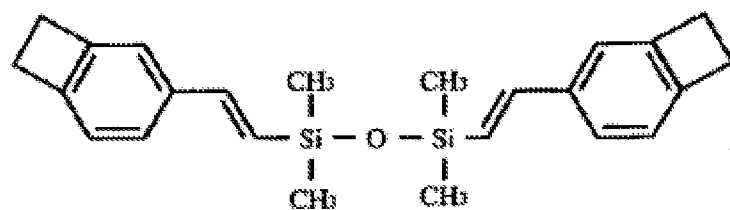
Regarding claim 3, Miyoshi et al. discloses said straight-chain organic silica compounds have a structure represented by the following formula (1):



Art Unit: 2813

where R1 to R6, which may be the same or different, respectively represent any one selected from the group consisting of hydrogen, a hydrocarbon group and a hydrocarbon oxide group [0047].

Regarding claim 8, Miyoshi et al. discloses wherein said cyclic organic silica compounds are tetravinyltetramethyl-cyclotetrasiloxane monomers represented by the formula (4) and said straight-chain organic silica compounds are divinylsiloxanebenzocyclobutene monomers represented by the following formula (5) [0044][0047]:



Regarding claim 18, Miyoshi et al. discloses wherein said straight-chain organic silica compounds have a structure represented by said formula (1) [0047].

Regarding claim 22, Miyoshi et al. discloses said straight-chain organic silica compounds are divinylsiloxanebenzocyclobutene monomers represented by said formula (5) [0047].

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

Art Unit: 2813

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Miyoshi (US Pub no. 2004/0253777 A1) in view of Hayashi (US Pub no. 2005/0267253 A1).

Regarding claim 4, Miyoshi et al. discloses all the claim limitations of claim 2 but fails to teach wherein a supply ratio of said cyclic organic silica compounds to said straight-chain organic silica compounds is changed during film formation.

Hayashi et al. teaches a supply ratio of said cyclic organic silica compounds to said straight-chain organic silica compounds is changed during film formation [0138]. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of producing a porous insulating film of Miyoshi et al. with a supply ratio of said cyclic organic silica compounds to said straight-chain organic silica compounds is changed during film formation taught by Hayashi et al. since doing so would provide excellent mechanical strength and deposition properties.

9. Claims 10 & 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyoshi (US Pub no. 2004/0253777 A1) in view of Gleason (US Pub no. 2004/0137243 A1).

Art Unit: 2813

Regarding claim 10, Miyoshi et al. discloses all the claim limitations of claim 1 but fails to teach said plasma is plasma of mixture gas of rare gas and oxidizer gas or hydrogenated silicon gas.

However, Gleason et al. teaches plasma is plasma of mixture gas of rare gas and oxidizer gas [0098]. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of producing a porous insulating film of Miyoshi et al with plasma of mixture gas of rare gas and oxidizer gas taught by Gleason et al. since doing so induces polymerization.

Regarding claim 14, Gleason et al. teaches wherein the diameter of pores contained in the film is 3 nm or less [0130].

10. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Miyoshi (US Pub no. 2004/0253777 A1) in view of Hayashi (US Pub no. 2005/0267253 A1).

Regarding claim 17, Miyoshi et al. discloses all the claim limitations of claim 16 but fails to teach wherein in the vicinity of an interface between the porous insulating film and a non-porous insulating film, a relative concentration of carbon atom in at least the porous insulating film changes stepwise or continuously.

However, Hayashi et al. discloses wherein in the vicinity of an interface between the porous insulating film and a non-porous insulating film, a relative concentration of carbon atom in at least the porous insulating film changes stepwise or continuously [0138]. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of producing a porous insulating film of Miyoshi et al.

Art Unit: 2813

with a relative concentration of carbon atom in at least the porous insulating film changes stepwise or continuously as taught by Hayashi et al. since doing so would provide excellent mechanical strength and deposition properties.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LATANYA CRAWFORD whose telephone number is (571)270-3208. The examiner can normally be reached on Monday-Friday 7:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571)-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Zandra V. Smith/
Supervisory Patent Examiner, Art
Unit 2822

Application/Control Number: 10/580,606
Art Unit: 2813

Page 12

/LaTanya Crawford/
Examiner, Art Unit 2813